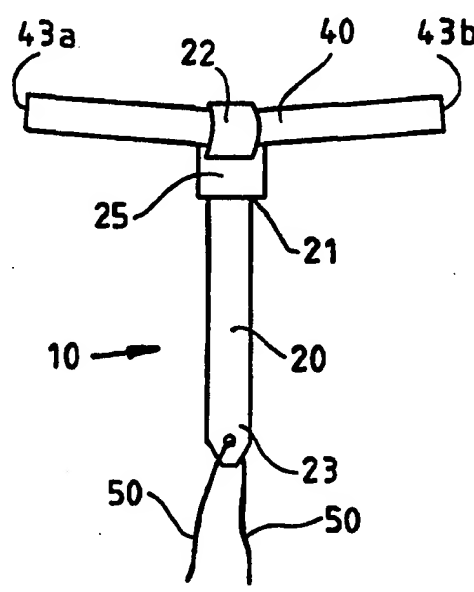


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International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/FI95/00270 (22) International Filing Date: 19 May 1995 (19.05.95) (30) Priority Data: 943201 5 July 1994 (05.07.94) FI (71) Applicant (for all designated States except US): LEIRAS OY [FI/FI]; P1 415, FIN-20101 Turku (FI). (72) Inventors; and (75) Inventors/Applicants (for US only): LEHTINEN, Matti [FI/FI]; Pyhän Katariinan tie 316, FIN-20760 Piispanristi (FI). PUHAKKA, Olli [FI/FI]; Lipunkantajankatu 5 C 39, FIN-20360 Turku (FI). (74) Agent: TURUN PATENTTITOIMISTO OY; P.O. Box 99, FIN-20521 Turku (FI).		(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TT, UA, UG, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG). Published <i>With international search report.</i> <i>With amended claims.</i>
(54) Title: DEVICE FOR THE RELEASE OF AN ACTIVE AGENT (57) Abstract <p>The invention relates to an intrauterine body (10) essentially in the shape of a T for releasing an active agent comprising an elongated stem (20). To one end (21) of the stem an elongated transverse part (40) is joined so that this and the stem (20) together form the body (10) essentially in the shape of a T. According to the invention, the transverse part (40) comprises a polymer matrix reservoir (41) containing an active agent. The stem (20) may be a polymer matrix reservoir containing an active agent or a part which contains no active agent.</p> 		

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DEVICE FOR THE RELEASE OF AN ACTIVE AGENT

The invention relates to an intrauterine device substantially in the shape of a T for releasing an active agent like a hormone.

A widely used intrauterine contraceptive is a T-shaped body
5 made of plastic comprising an elongated stem part one end
of which is connected with a transverse part so that the
stem and the transverse part together form a body
substantially in the shape of a T. The stem is partly
twisted by a copper wire which is capable of releasing
10 copper ions. The device is inserted into the uterus by a
separate insertion device. Attached to the device is a
thread which is so long that it extends outside the uterine
cervix when the device is in inserted position.

T-shaped intrauterine devices releasing hormones and other
15 active agents for contraception and treatment of hormonal
disorders are also known in literature. US patent 3,935,860
describes a T-shaped body comprising a reservoir surrounded
by a wall wherein the hormone is intermixed with the
carrier. The wall is made of a substance which releases the
20 active agent at a controlled rate. The carrier which is
solid or liquid contains the active agent which is
progestational or estrogenic hormone.

US patent 4,014,988 describes also a T-shaped body which
comprises a reservoir surrounded by a wall containing
25 progestational hormone intermixed with a carrier. The wall
is made of a material which releases the hormone at a
controlled rate.

US patents 4,264,575 - 4,264,578 describe intrauterine
devices in which the active agent is dispersed into a
30 silicon polymer which releases the agent at a controlled
rate. The patent publications do not separately describe

any particular device configurations but it is mentioned that the device may have e.g. a shape of a T.

US patent 4,180,064 discloses various intrauterine devices, a T-shaped device among others, wherein the progestational or estrogenic hormone is intermixed with a biodegradable polymer.

Common to the above T-shaped devices releasing hormone or other active agents is that both the stem and its transverse part together form one single piece. For this reason the device is complicated to manufacture and it is expensive and insertion of the device into the uterus is problematic.

A commercially available levonorgestrel releasing contraceptive comprises a T-shaped device with a sheath-like polymer reservoir containing the hormone levonorgestrel, the reservoir being fitted around its vertical polyethylene stem. One way of fabricating it has been published in the international patent application PCT/FI93/00296. One aspect associated with this solution is that while the device is in inserted position in the uterus, release of the active agent takes place only in the lower part of the uterus. From the point of view of the results of treatment with active agents used for contraception as well as for other purposes, it is advantageous that their release takes place as high in the uterus as possible. This result can be achieved if the reservoir containing the active agent is placed higher in the T-piece than in the known levonorgestrel releasing contraceptive.

The purpose of this invention is to eliminate the above drawbacks and to obtain a novel, essentially T-shaped intrauterine device containing an active agent which is the most effective possible from the point of view of the treatment and which is simple to manufacture and easy to

insert into the uterus.

A so-called bundle tie a fastening means widely used, for instance, in the field of packaging. It comprises a strip of flexible material, e.g. plastic, with a ring formed at its one end having grooves on its inner side. The other end of the strip is passed through the ring thus forming a loop. The strip is provided with ridges essentially over the entire length of the strip which fit into the grooves formed in the ring. The ridges and the grooves are so shaped that pulling of the strip to tighten up the loop is possible whereas pulling of the strip in opposite direction to loosen the loop is impossible.

Some of the solutions according to this invention are based on the utilization of the bundle tie technique.

The object of the invention is therefore an intrauterine device essentially in the shape of a T for releasing an active agent comprising an elongated stem, to one end of which an elongated transverse part is joined so that this and the stem together form the body essentially in the shape of a T. The invention is characterized in that the transverse part comprises a polymer matrix reservoir containing the active agent and that the stem either comprises a polymer matrix reservoir containing the active agent or that it is a part which contains no active agent.

According to one embodiment the stem is secured to the transverse part by tightening a fastening means at the end of the stem partly or wholly around the transverse part.

The reservoir containing the active agent may be surrounded by such a membrane which is capable of releasing the active agent at a predetermined rate.

The active agent may be e.g. a hormone suitable for the treatment of menopausal symptoms or contraception,

particularly estrogenic or progestational hormone.

The matrix reservoir containing the active agent and the surrounding membrane can be made of the same or different polymer or polymer mixture. It is essential that both the material of the matrix and the possible surrounding membrane is made of a flexible polymer. Silicon polymers are particularly suitable for this purpose.

The invention is described in the following referring to the enclosed drawings in which

- 10 Fig. 1 shows a plan view of the T-shaped body according to the invention in which the stem is secured to the transverse part by tightening the fastening means formed at the end of the stem around the transverse part
- 15 Fig. 2 shows a side view of the T-shaped body of Fig. 1
- Fig. 3 shows the T-shaped body fitted into an insertion tube
- Fig. 4 shows a cross-sectional view of the stem which together with the fastening means together with the stem form a uniform piece
- 20 Fig. 5 shows the stem of Fig. 4 according to a second embodiment
- Fig. 6 shows the stem of Fig. 4 according to a third embodiment
- 25 Fig. 7 shows the stem of Fig. 4 according to a fourth embodiment
- Fig. 8 shows the stem of Fig. 4 according to a fifth embodiment

- Fig. 9 shows the stem of Fig. 4 according to a sixth embodiment
- 5 Fig. 10 shows the stem which is to be joined to the transverse part and in which the fastening means is a separate piece which can be secured to the stem
- 10 Fig. 11 shows a T-shaped body where also the stem is a polymer matrix reservoir containing the active agent
- Fig. 12 shows a fastening means suitable for joining the stem of Fig. 11 and the transverse part together
- Fig. 13 shows the fastening means of Fig. 12 according to a second embodiment
- 15 Fig. 14 shows a T-shaped body with two transverse parts joined to the stem
- Fig. 15 shows a stem suitable for joining two transverse parts.
- 20 Fig. 1 shows a T-shaped body 10 according to the invention wherein the stem 20 is secured to a transverse part 40 by tightening the fastening means 22 formed at the end 21 of the stem around the transverse part 40 according to the so-called bundle tie technique. Securing to a ring 25 located at the end of the fastening means takes place in the way which is illustrated more clearly e.g. in Figs. 4 and 5. A pull-out thread 50 is attached to the opposite end 23 of the stem 20. Fig. 2 shows the T-shaped body of Fig. 1 seen from the side. In this solution the transverse part 40 comprises both a polymer matrix reservoir 41, which contains the active agent, and a covering membrane 42
- 30

surrounding the reservoir 41 which is capable of controlling the release rate of the active agent. The ends 43a, 43b (Fig. 1) of the transverse part 40 are preferably uncovered. Hence the release rate of the active agent at the ends is higher than from the area covered by the membrane 42 and this is an advantage from the point of view of the result of treatment.

Fig. 3 shows the T-shaped body seen from the front fitted into a cross-sectioned insertion tube 51. The size of the ring 25 of the fastening means 22 most preferably matches with the outer diameter of the insertion tube 51. Figure shows that the diameter of the fastening means tapers upwards. This shape is particularly suitable from the point of view of the insertion. The transverse part 40 is made of a very flexible polymer material and as the insertion device is introduced through the uterine cervix, the wings 44a, 44b of the body 40 on both sides of the fastening means 22 readily bend downwards so that they follow the insertion tube as indicated by the dashed lines upon penetrating the uterine cervix. The polymer material must be flexible enough so that the part 40 straightens again inside the uterus.

Fig. 4 shows as a cross-section the stem 20 of the T-shaped body of Figs. 1-3 and one embodiment of the fastening element bent into a loop. The fastening means 22, which is of the same piece as the stem itself, comprises also the loop 25 formed at its end. The fastening means 22 is provided, at least within the part to be secured, with ridges 27 which lock with the grooves 26 formed on the inside of the ring 25. The ridges 27 and the grooves 26 are so shaped that tightening in the direction of the arrow is allowed but loosening in the opposite direction of the arrow is prevented. If desired, the stem 20 can be provided with ridges over the entire length in which case adjustment possibilities are not limited.

In Fig. 5 the ridges 27 have been replaced by a single dovetail barb 27' which locks against the lower surface of the ring 25.

Fig. 6 shows a third embodiment of the stem 20 and the fastening means. Here also the fastening means is of the same piece as the stem itself and it comprises an annular ring 25 with a hole of exactly the right size to allow the spherical parts 28 fitted along the stem to be pulled through the hole by pulling hard enough in the direction of the arrow.

Fig. 7 shows a fourth embodiment of the stem and the fastening means. The fastening means 22, which together with the stem constitute one piece, is a loop whose ends 20 and 30 can be locked to one another by means of a dovetail barb 27' formed at the end 29 and a groove 26' shaped at the end 30.

Fig. 8 shows a fifth embodiment of the stem and the fastening means. The end 29 of the fastening means 22 forming a loop is provided with ridges 27 and the loop can be locked by pushing the end 29 with the ridges to a desired depth into the opposite end 30 which is provided with such grooves 26 the pull-out of the end 29 out of the end 30 is prevented.

In Fig. 9 the fastening means 22 forms an open loop whose ends 29, 30 need not be interlocked. In the assembly of the T-shaped body the transverse part is pressed down between the flexible ends 29, 30. Due to the tension of the ends 29, 30 of the loop, the transverse part is held fast in the grip of loop.

Fig. 10 shows a stem in which the fastening means 22 is separate loop which can be locked to the stem 20. It has barbs at both ends 29, 30 and locking takes place as the ends are placed against one another and are pushed into the

groove 26 formed into the shaped end 21 of the stem.

Fig. 11 shows a T-shaped body in which also the stem 20 is a polymer matrix reservoir containing the active agent. The stem 20 and the transverse part 40 are attached to each other with a separate fastening means 22 which is shown in more detail in Figs. 12 and 13. The principle of operation of the fastening means of Fig. 12 corresponds to the loop shown in Fig. 9. The loop 22 in the vertical plane holds the transverse part of the T-shaped body and the open loop 33 in the horizontal plane holds the end of the stem. Due to the tension of the ends 34, 35 of the loop 33, the end of the stem is held fast in the grip of the loop.

Fig. 13 shows a solution which is an alternative to that of Fig. 12. Also in this solution the loop 22 in the vertical plane holds fast the transverse part of the T-shaped body and the loop 33 in the horizontal plane holds the end of the stem. The ends are interlocked according to the principle of the solution of Fig. 7.

Fig. 14 shows a T-shaped body in which two transverse parts 40 and 40' are joined to the stem both of which comprise polymer matrix reservoirs containing the active agent.

Fig. 15 shows a stem 20 suitable for joining two transverse parts. The fastening means 22, which corresponds to that of Fig. 9, holds the upper transverse part 40 in place. The lower fastening means 22', which functions according to the same fastening principle as the upper fastening means 22, opens to one or the other side and fastening of the lower transverse part 40' takes place by pushing it into the loop 22' from the side.

In those solution where the device 10 comprises two separate polymer matrix reservoirs, either so that the device has two transverse parts 40, 40' or so that also the stem 20 forms a polymer matrix reservoir, the reservoirs

can contain the same or different active agents. For example, one reservoir may contain hormone and the other reservoir agent which prevents inflammation.

It is obvious to a specialist in the field that different
5 embodiments of the invention can vary within the limits of the claims presented hereinafter.

CLAIMS

1. An intrauterine body (10) essentially in the shape of a T for releasing an active agent comprising an elongated stem (20), to one end (21) of which an elongated transverse part (40) is joined so that this and the stem (20) together
5 form the body (10) essentially in the shape of a T, characterized in that the transverse part (40) comprises a polymer matrix reservoir (41) containing an active agent and that the stem (20) either comprises a polymer matrix reservoir containing an active agent or that it is a part
10 which contains no active agent.
2. A T-shaped body according to claim 1 characterized in that the stem (20) is a part made of a suitable material, containing no active agent and that it is secured to the transverse part (40) by tightening a fastening means (22)
15 at the end (21) of the stem partly or wholly around the transverse part (40).
3. A T-shaped body according to claim 2 characterized in that the stem (20) and the fastening means (22) form a uniform piece.
- 20 4. A T-shaped body according to claim 2 characterized in that the fastening means (22) is a separate piece which can be secured to the stem (20).
5. A T-shaped body according to claim 1 characterized in that the stem (20) comprises a polymer matrix reservoir
25 containing the active agent and that the stem is attached to the transverse part (40) by means of a separate fastening means (22).
6. A T-shaped body according to claim 2 characterized in that the stem (20) and the fastening means (22) form one
30 piece and that the stem has also another fastening means

(22') to which a second polymer matrix reservoir (41') containing the active agent is attached.

7. A T-shaped body according to claim 1 or 6 characterized in that the transverse part (40, 40') is a polymer matrix reservoir (41, 41') containing the active agent and that this is surrounded by a membrane (42, 42') which is capable of releasing the active agent at a predetermined rate.
8. A T-shaped body according to claim 1 characterized in that the active agent is a hormone suitable for the treatment of menopausal symptoms or contraception.
9. A T-shaped body according to claim 8 characterized in that the hormone is estrogen or progestin.

AMENDED CLAIMS

[received by the International Bureau on 27 November 1995 (27.11.95);
original claims 1-9 replaced by amended claims (2 pages)]

1. An intrauterine body (10) essentially in the shape of a T for releasing an active agent comprising an elongated stem (20), to one end (21) of which an elongated transverse part (40) is joined so that this and the stem (20) together
5 form the body (10) essentially in the shape of a T, wherein the transverse part (40) comprises a polymer matrix reservoir (41) containing an active agent and the stem (20) either comprises a polymer matrix reservoir containing an active agent or that it is a part which contains no active
10 agent, characterized in that
- the stem (20), which is a part made of a suitable material, containing no active agent, is secured to the transverse part (40) by tightening a fastening means (22) at the end (21) of the stem partly or wholly around the
15 transverse part (40), and
 - (i) the stem (20) and the fastening means (22) form a uniform piece, or
 - (ii) the fastening means (22) is a separate piece which can be secured to the stem (20); or
 - 20 - that the stem (20), which comprises a polymer matrix reservoir containing the active agent, is attached to the transverse part (40) by means of a separate fastening means (22).
6. A T-shaped body according to claim 1 characterized in
25 that the stem (20) and the fastening means (22) form one piece and that the stem has also another fastening means (22') to which a second polymer matrix reservoir (41') containing the active agent is attached.
3. A T-shaped body according to claim 1 or 2 characterized
30 in that the transverse part (40, 40') is a polymer matrix reservoir (41, 41') containing the active agent and that this is surrounded by a membrane (42, 42') which is capable of releasing the active agent at a predetermined rate.

4. A T-shaped body according to claim 1, 2 or 3 characterized in that the active agent is a hormone suitable for the treatment of menopausal symptoms or contraception.
- 5 5. A T-shaped body according to claim 4 characterized in that the hormone is estrogen or progestin.

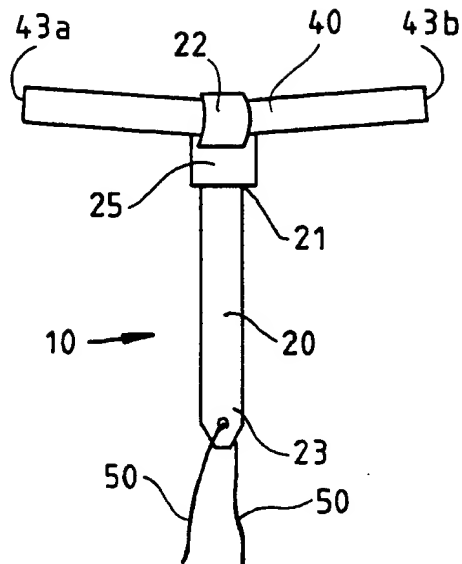


FIG. 1

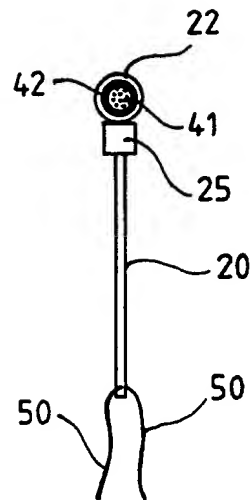


FIG. 2

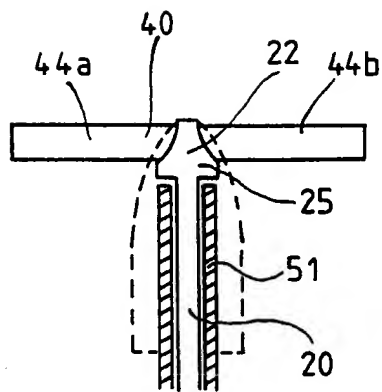


FIG. 3

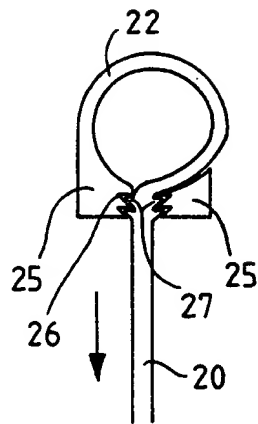


FIG. 4

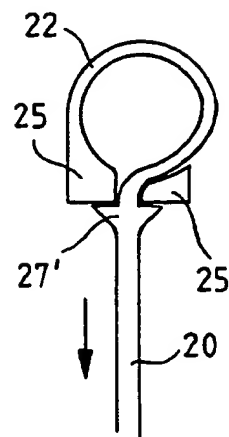


FIG. 5

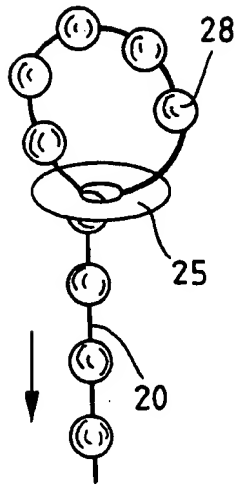


FIG. 6

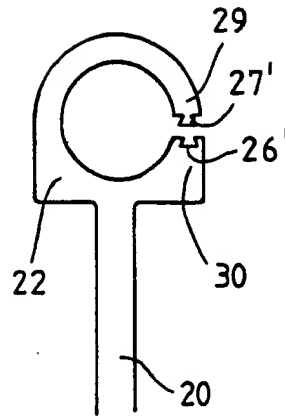


FIG. 7

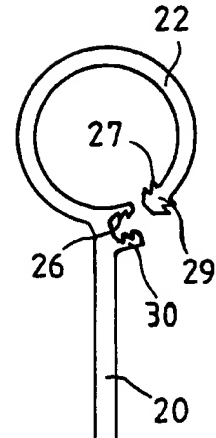


FIG. 8

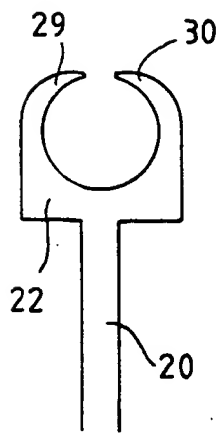


FIG. 9

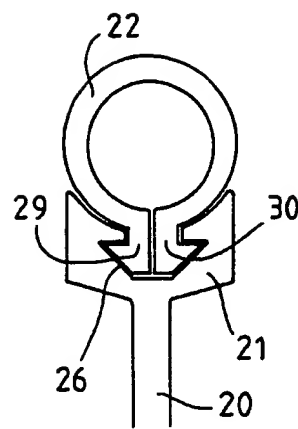


FIG. 10

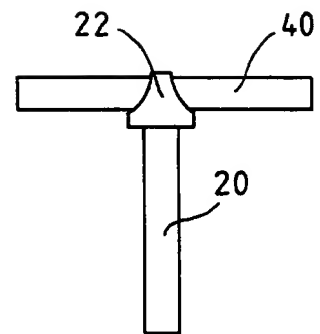


FIG. 11

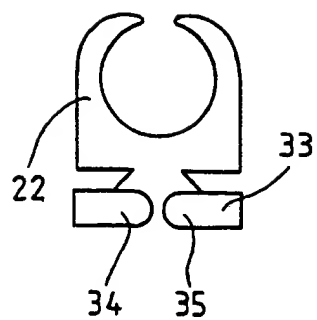


FIG. 12

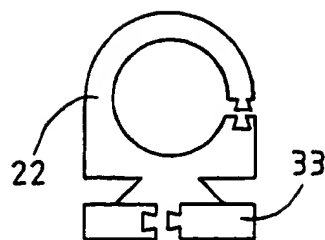


FIG. 13

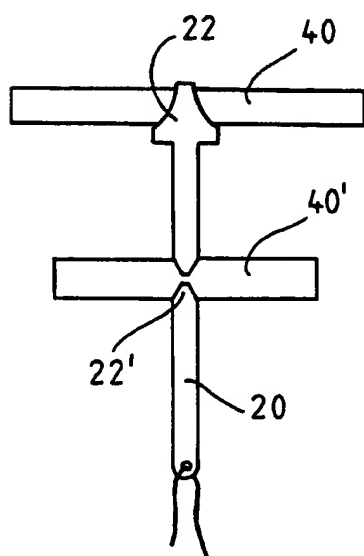


FIG. 14

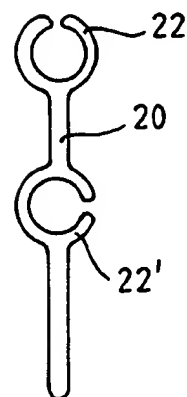


FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 95/00270

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: A61F 6/14, A61K 9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: A61F, A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DIALOG, QUESTEL 2

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CH 638397 A5 (PATRICK SECK-LAI WONG), 30 Sept 1983 (30.09.83), page 3, line 52 - line 63, figure 2 --	1,5,7
X	US 3845761 A (A. ZAFFARONI), 5 November 1974 (05.11.74), column 19, line 5 - line 68, figures 1-2 --	1,5,7-9
X	US 4014988 A (B.B. PHARRISS ET AL.), 29 March 1977 (29.03.77), column 3, line 16 - line 21, figure 2 --	1,5,7-9
A	WO 9107934 A1 (METALLICOM A.G.), 13 June 1991 (13.06.91), figure 1 --	1-2,4-5

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

9 November 1995

Date of mailing of the international search report

15 - 11 - 1995

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 95/00270

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4180064 A (J. HELLER ET AL.), 25 December 1979 (25.12.79), column 14, line 42 - column 15, line 4, figure 7 --	1-3,7-9
A	US 4198966 A (S. KAIVOLA), 22 April 1980 (22.04.80), figures 1-3 --	1-2,4
A	US 4326511 A (C.E. ZIMMERMAN), 27 April 1982 (27.04.82), figure 1 --	6
A	US 4582052 A (R.L. DUNN ET AL.), 15 April 1986 (15.04.86), figures 3,7 -- -----	1-3,5,7

INTERNATIONAL SEARCH REPORT
Information on patent family members

02/10/95

International application No.
PCT/FI 95/00270

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US-A- 3845761	05/11/74	US-A- 3854480 US-A- 3896819 US-A- 3948262 US-A- 3967618 US-A- 3993073 AT-B- 336189 AU-B- 467246 AU-A- 4696972 BE-A,A- 789524 CA-A- 993358 CH-A- 576794 DE-A,C,C 2247949 FR-A,B- 2158201 GB-A- 1414812 NL-A- 7213250 SE-B,C- 396695	17/12/74 29/07/75 06/04/76 06/07/76 23/11/76 25/04/77 27/11/75 28/03/74 15/01/73 20/07/76 30/06/76 05/04/73 15/06/73 19/11/75 03/04/73 03/10/77
US-A- 4014988	29/03/77	NONE	
WO-A1- 9107934	13/06/91	AT-T- 117530 AU-A- 6730590 DE-D,T- 69016407 EP-A,B- 0455767 ES-T- 2068402	15/02/95 26/06/91 01/06/95 13/11/91 16/04/95
US-A- 4180064	25/12/79	AT-B- 341100 AU-A- 6380473 BE-A,A- 809161 CA-A- 1046408 CH-A- 603165 DE-A,B,B 2363963 FR-A,B- 2247259 GB-A- 1417527 JP-A- 49094818 NL-A- 7317731 SE-B,C- 433908	25/01/78 19/06/75 16/04/74 16/01/79 15/08/78 11/07/74 09/05/75 10/12/75 09/09/74 01/07/74 25/06/84
US-A- 4198966	22/04/80	DE-A,C,C 2923764 GB-A,B- 2024020 JP-A- 55005700	17/01/80 09/01/80 16/01/80
US-A- 4326511	27/04/82	NONE	
US-A- 4582052	15/04/86	NONE	